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Signed this 28th day of October 2009



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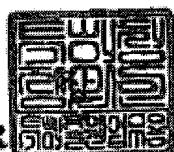
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5	[Document Name]	Patent Application
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	[Title of Invention]	사용자의 저시력 시각이상 증후 특성 및 컨텐츠 재생 취향에 따른 비주얼 컨텐츠 적용 변환 방법 및 시스템
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20 [Purport] A patent application for the
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[ABSTRACT]

[Abstract]

When using visual content, a user with visual impairment may not discern necessary information from visual content due to vision degradation resulting from the visual impairment characteristics. The present invention includes adaptive content transformation methods and devices according to an input data description structure for transforming visual content adaptively according to the user's low vision characteristic symptoms and representing presentation priorities of multimedia content, the user's preferences for transformation between different types of content, and the user's presentation preference information regarding image qualities of visual content by using the user's general presentation preference information. An input data description structure for adaptive transformation of visual content for a user with visual impairment is used to divide visual impairment symptoms into three types of symptom degree (mild, medium, and severe) according to the visual impairment symptom degrees, and describe each of the visual impairment characteristics. An adaptive transformation method for visual content comprises a visual impairment compensation adaptive transformation algorithm for representing severe visual impairment symptoms, an adaptive transformation algorithm for a medium visual impairment, and an adaptive transformation algorithm for a mild visual impairment. In order to analyze the user's visual impairment symptom information and compensate for the corresponding visual impairment symptoms, each of the adaptive transformation algorithms uses various image processing techniques, such as brightness control, sharpness control, contrast control, glare attenuation, change of image and font sizes, and change of font styles and colors, for visual content. Also, in the case of a very severe visual impairment or loss of

eyesight (a blind person), video or character information is converted into voice or audio information (modality conversion) to transform visual content into audio format, thereby making it possible

5 to transfer the visual content information to the user while minimizing information loss. The results of the adaptive conversion are verified through a program that enables a general user to experience the low vision characteristics of a user with a visual impairment. The

10 present invention also comprises an adaptive content transformation method according to an input data description structure for representing a user's presentation preference information that can transform contents adaptively and in conformity with the user's

15 presentation preferences in consumable presentation of multimedia content. The user's presentation preference information for adaptive transformation of multimedia content includes presentation priority preferences according to the types of multimedia content (e.g.,

20 characters, video, and audio), the user's preferences for transformation between different types of content (e.g., transformation of character and video content into audio content), and the user's preferences for image quality of visual content (e.g., brightness, the

25 degree of fine detail, contrast, the number of intensity levels, gray/color selection, the minimum font size of character information, the style and color of a font, and viewing distance). The present invention provides an input data description structure for

30 representing the user's presentation preference information and an adaptive content transformation method according to the same. The present invention is applicable to the Digital Item Adaptation of the MPEG-21 Part 7 that is being standardized to implement a

35 multimedia integrated framework for freely using multimedia content under different network or device environments by integrating the standards of conventional MPEG (Motion Picture Expert Group) and the standards of other standardization groups.

[Representative Drawing]

FIG. 1

5 [Index]

Visual impairment, Low Vision, Visual impairment Symptom, Adaptive Transform, MPEG-21, Digital Item Adaptation

[SPECIFICATION]

[TITLE OF THE INVENTION]

5 METHOD AND SYSTEM FOR TRANSFORMING ADAPTIVELY
VISUAL CONTENT ACCORDING TO USER'S SYMPTOM
CHARACTERISTICS OF LOW VISION IMPAIRMENT AND USER'S
PRESENTATION PREFERENCES

[BRIEF DESCRIPTION OF THE DRAWINGS]

10 FIG. 1 is a block diagram of an overall system
according to the present invention.

FIG. 2 is a diagram illustrating an input
information description structure according to the
present invention.

15 FIG. 3 is a diagram illustrating visual impairment
symptoms and an adaptive transformation for
compensation for the same according to an embodiment of
the present invention.

20 [DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[TECHNICAL FIELD OF THE INVENTION AND RELATED ART]

25 The present invention relates to a method for
adaptively transforming visual content that a user with
visual impairment intends to use according to the
symptom characteristics of the user's visual impairment,
and to an input data description structure, in order to
solve the problem of users with visual impairment
30 perceiving incorrect information from visual data
contents, and allow such users to receive the same
information from contents that users without visual
impairment receive.

35 A group of video professionals constituting the
SC29 Working Group of JTC1 (Joint Technical Committee
1) of the international standards bodies for multimedia,
the ISO/IEC (International Standard Organization /
International Electrotechnical Committee), is striving
to establish a next-generation standard for a
multimedia framework in MPEG as MPEG-21, by

consolidating existing standards of MPEG and other standards organizations and large-scale networks or terminals existing in different social environments, to form a combined multimedia framework that allows for
5 unrestricted and convenient use of multimedia content, regardless of the user circumstances. Adaptive transformation of digital items of subclass 7 in MPEG-21, as a category for adaptively transforming multimedia content (digital items) according to a
10 network or terminal, or user characteristics, is currently in the standardization process. To this end, the present invention discloses visual impairment symptoms of users in Table 1, and based on the latter, the present invention sets forth a method of presenting
15 visual information to be viewable by even people with visual impairment.

[Table 1]

Typical Symptoms of Visual impairment
<ul style="list-style-type: none">- Reduced fine detail- Reduced contrast- Increased need of light (e.g., night blindness)- Loss of peripheral vision field- Loss of central vision field- Hemianopia

20

[TECHNICAL OBJECT OF THE INVENTION]

The present invention is intended to provide semantic information of visual content corresponding to a general user to a user with visual impairment,
25 regardless of the type of visual impairment or separate special equipment. The present invention is also intended to provide an adaptive transformation function in conformity with user's preferences in the consumptive presentation of media contents by using the
30 user's presentation preference information. To this end, the present invention defines an input data description structure for the user's visual impairment symptoms and

an input data description structure for the user's presentation preferences, and describes an adaptive transformation method according to the user's visual impairment characteristics for each digital item.

5

[CONFIGURATION AND OPERATION OF THE INVENTION]

To achieve the above objects, the present invention may comprise four important parts: 1) an input data description structure for a visual content 10 adaptive transformation method, 2) an adaptive transformation method for visual impairment, and 3) an adaptive transformation method for satisfying user's presentation preferences.

Hereinafter, an embodiment of the present 15 invention will be described with reference to the accompanying drawings and equations.

In an overall system structure of the present invention (FIG. 1), a visual content input unit 100 and a visual content conversion unit 300 perform an 20 adaptive transformation process according to an input data description structure 200 (presentation preference information and visual impairment symptom information of a user with visual impairment), and then a visual content output unit 400 outputs adaptively transformed 25 visual content.

As illustrated in FIG. 2, the input data description structure 200 of the adaptive transformation method includes a user visual impairment symptom description unit 210 and a user presentation 30 preference description unit 220. The user visual impairment symptom description unit 210 includes a descriptor 211 for representing the degree of the loss of fine detail among a user's visual impairment symptoms, a descriptor 212 for representing the degree 35 of lack of contrast, a descriptor 213 for representing the degree of the increased need of light, a descriptor 214 for representing the degree of the loss of peripheral vision field, a descriptor 215 for representing the degree of the loss of central vision

field, a descriptor 216 for representing the degree of the loss of a left or right half side of a hemianopia vision field, and a numerical (0-1) descriptor and a narrative (mild, medium, severe) descriptor 215 for 5 representing a visual impairment symptom degree level.

Also, the user presentation preference description unit 220, which is used to analyze presentation preference information and then consumably present adaptively-transformed visual content, includes a 10 content type presentation priority preference 221, a sharpness presentation preference 222, an enlargement presentation preference 223, an explanation presentation preference 224, a modality conversion presentation preference 225, an intensity level number 15 presentation preference 226, a gray/color selection presentation preference 227, a minimum font size selection presentation preference 228, a font color and background color selection presentation preference 229, a font style selection presentation preference 230, and 20 a user's viewing distance designation presentation preference 231.

Table 2 below shows an embodiment of describing the user visual impairment information of FIG. 2 as an XML document.

[Table 2a]

```
<!-- ##### -->
<!-- Definition of VisualImpairmentType -->
<!-- ##### -->

<complexType name="VisualImpairmentType">
  <sequence>
    <element name="Blindness" minOccurs="0">
      <complexType>
        <attribute name="eyeSide">
          <simpleType>
            <restriction base="string">
              <enumeration value="both"/>
              <enumeration value="left"/>
              <enumeration value="right"/>
            </restriction>
          </simpleType>
        </attribute>
      </complexType>
    </element>
    <element name="LowVisionSymptoms"
      type="dia:LowVisionImpairmentType" minOccurs="0"/>
  </sequence>
  <attribute name="Sightless" type="boolean" use="required"/>
  <attribute name="HasColorVisionDeficiency" type="boolean"
    use="required"/>
</complexType>

<!-- ##### -->
<!-- Definition of LowVisionImpairment -->
<!-- ##### -->
```

[Table 2b]

```
<complexType name="LowVisionImpairmentType">
  <sequence>
    <element name="LossOfFineDetail" minOccurs="0">
      <complexType>
        <attribute name="level"
          type="dia:SymptomDegreeType"/>
      </complexType>
    </element>
    <element name="LackOfContrast" minOccurs="0">
      <complexType>
        <attribute name="level"
          type="dia:SymptomDegreeType"/>
      </complexType>
    </element>
    <element name="LightSensitivity" minOccurs="0">
      <complexType>
        <attribute name="level"
          type="dia:SymptomDegreeType"/>
      </complexType>
    </element>
    <element name="NeedOfLight" minOccurs="0">
      <complexType>
        <attribute name="level"
          type="dia:SymptomDegreeType"/>
      </complexType>
    </element>
    <element name="PartialVisionLoss" minOccurs="0">
      <complexType>
        <sequence>
          <element name="Center" minOccurs="0">
            <complexType>
              <attribute name="level"
                type="dia:SymptomDegreeType"/>
            </complexType>
          </element>
          <element name="Peripheral" minOccurs="0">
            <complexType>
              <attribute name="level"
                type="dia:SymptomDegreeType"/>
            </complexType>
          </element>
          <element name="Hemianopia" minOccurs="0">
            <complexType>

```

[Table 2c]

```
<attribute name="side">
  <simpleType>
    <restriction base="string">
      <enumeration value="left"/>
      <enumeration value="right"/>
    </restriction>
  </simpleType>
</attribute>
<attribute name="level"
  type="dia:SymptomDegreeType"/>
</complexType>
</element>
</sequence>
</complexType>
</element>
</sequence>
</complexType>

<simpleType name="SymptomDegreeType">
  <restriction base="string">
    <enumeration value="mild"/>
    <enumeration value="medium"/>
    <enumeration value="severe"/>
  </restriction>
</simpleType>
```

5

Table 3 below shows examples of the user presentation preference information written in Table 2 above written as an XML document.

10 [Table 3a]

```
<!-- Definition of ExtendedPresentationPreferences -->
<!-- Definition of ExtendedPresentationPreferences -->
<!-- Definition of ExtendedPresentationPreferences -->

<complexType name="ExtendedPresentationPreferencesType">
  <complexContent>
    <extension base="dia:PresentationPreferencesType">
      <sequence>
        <element name="PresentationPriority" minOccurs="0">
          <complexType>
            <sequence>
              <element name="AudioPresentationPriority"
                type="mpeg7:unsigned8"/>
              <element name="TextPresentationPriority"
```

[Table 3b]

type="mpeg7:unsigned8"/>	
<element name="ImagePresentationPriority"	
type="mpeg7:unsigned8"/>	
<element name="VideoPresentationPriority"	
type="mpeg7:unsigned8"/>	
</sequence>	
</complexType>	
</element>	
<element name="AdditionalDisplay"	
type="dia:AdditionalDisplayPresentationPreferencesType"	
minOccurs="0"/>	
</sequence>	
</extension>	
</complexContent>	
</complexType>	
c!-- #####	
<!-- Definition of AdditionalDisplayPresentationPreferences	
<!-- #####	
<complexType name="AdditionalDisplayPresentationPreferencesType">	
<sequence>	
<element name="ImageDisplayPresentationPreferences"	
type="dia:ImageDisplayPresentationPreferencesType"	
minOccurs="0"/>	
</element>	
<element name="TextDisplayPresentationPreferences"	
type="dia:TextDisplayPresentationPreferencesType"	
minOccurs="0"/>	
</element>	
<element name="ViewingDistance" type="mpeg7:unsigned16"	
minOccurs="0"/>	
</sequence>	
</complexType>	
<complexType name="ImageDisplayPresentationPreferencesType">	
<choice>	
<element name="ImageModalityConversionPreference"	
type="dia:ImageModalityConversionPreferenceType"	
minOccurs="0"/>	
<element name="ImageChoices" >	
<complexType>	
<sequence>	

[Table 3c]

```
<element name="SharpnessPreference"
  type="dia:SharpnessPreferenceType"
  minOccurs="0"/>
<element name="EnlargementPreference"
  type="dia:EnlargementPreferenceType"
  minOccurs="0"/>
<element name="ExplanationPreference"
  type="dia:ExplanationPreferenceType"
  minOccurs="0"/>
<element name="ImageModalityConversionPreference"
  type="dia:ImageModalityConversionPreferenceType"
  minOccurs="0"/>
<element name="DataReductionPreference"
  type="dia:DataReductionPreferenceType"
  minOccurs="0"/>
</sequence>
</complexType>
</element>
</choice>
</complexType>

<complexType name="TextDisplayPresentationPreferencesType">
<choice>
<element name="TextModalityConversionPreference"
  type="dia:TextModalityConversionPreferenceType"
  minOccurs="0"/>
<element name="FontChoices" >
<complexType>
<sequence>
<element name="MinimumFontSize" type="mpeg7:unsigned0"/>
<element name="ForegroundColor" >
<complexType>
<sequence minOccurs="1" maxOccurs="3">
<element name="Component" >
<simpleType>
<restriction base="string" >
<enumeration value="R" />
<enumeration value="G" />
<enumeration value="B" />
</restriction>
</simpleType>
</element>
<element name="Value" >
```

[Table 3d]

<pre> type="mpeg7:unsigned8" /> </sequence> </complexType> </element> <element name="BackgroundColor"> <complexType> <sequence minOccurs="1" maxOccurs="3" > <element name="Component"> <simpleType> <restriction base="string" > <enumeration value="R" /> <enumeration value="G" /> <enumeration value="B" /> </restriction> </simpleType> </element> <element name="Value"> type="mpeg7:unsigned8" /> </sequence> </complexType> </element> <element name="FontStyle"> <simpleType> <restriction base="string" > <enumeration value="regular" /> <enumeration value="bold" /> <enumeration value="italic" /> <enumeration value="bold italic" /> </restriction> </simpleType> </element> </sequence> </complexType> </element> <choice> </choice> </complexType> <simpleType name="ImageModalityConversionPreferenceType"> <restriction base="xs:string" > <enumeration value="Text" /> <enumeration value="Audio" /> </restriction> </simpleType></pre>
--

[Table 3e]

```
<simpleType name="TextModalityConversionPreferenceType">
  <restriction base=" xs:string" >
    <enumeration value=" Audio" />
  </restriction>
</simpleType>

<simpleType name="SharpnessPreferenceType">
  <restriction base=" xs:string" >
    <enumeration value=" Level-1" />
    <enumeration value=" Level-2" />
    <enumeration value=" Level-3" />
  </restriction>
</simpleType>

<simpleType name="EnlargementPreferenceType">
  <restriction base=" xs:string" >
    <enumeration value=" Level-1" />
    <enumeration value=" Level-2" />
    <enumeration value=" Level-3" />
  </restriction>
</simpleType>

<simpleType name="ExplanationPreferenceType">
  <restriction base=" xs:string" >
    <enumeration value=" Text" />
    <enumeration value=" Audio" />
  </restriction>
</simpleType>

<complexType name="DataReductionPreferenceType">
  <sequence>
    <element name=" NumberOfIntensityLevels" type="mpeg7:unsigned8" />
    <element name=" GrayOrColor" >
      <complexType>
        <choice>
          <element name=" GrayImage" >
            <simpleType>
              <restriction base="string" >
                <enumeration value="Gray" />
              </restriction>
            </simpleType>
          </element>
          <element name=" ColorImage-ColorDepth" type="
```

5

[Table 3f]

```
mpeg7:unsigned8" />
        </choice>
      </complexType>
    </element>
  <sequence>
</complexType>
```

10 FIG. 3 is a diagram illustrating a visual impairment symptom and an adaptive transformation for compensation

of the same according to an embodiment of the present invention.

[EFFECT OF THE INVENTION]

According to the present invention, a user with visual
5 impairment can receive almost equal semantic
information from visual content as general users
without using separate equipment, thereby enabling the
user with visual impairment to use multimedia content.
10 This is also applicable to the digital item adaptation
field of the international media standards MPEG-7 and
MPEG-21.

[CLAIMS]

[Claim 1]

5 An invention which comprises an adaptive transformation method according to visual impairment characteristics and an input information description structure for the same.

[Claim 2]

10 An invention which comprises an adaptive transformation method according to a user's presentation preference information and a definition of an input information description structure.

15 [Claim 3]

An invention which comprises an adaptive transformation method according to visual impairment characteristics and a user's presentation preference information, and an input information description structure for the same.

[Claim 4]

25 The invention according to Claim 1, which comprises displaying the presence or absence of the loss of left/right eyesight in representing the input information description structure.

[Claim 5]

30 The invention according to Claim 1, which comprises displaying the type of a visual impairment symptom in representing the input information description structure.

[Claim 6]

35 The invention according to Claim 1, which comprises descriptively representing the degree of a visual impairment symptom in representing the input information description structure.

[Claim 7]

The invention according to Claim 1, which comprises numerically representing the degree of a visual impairment symptom in representing the input 5 information description structure.

[Claim 8]

The invention according to Claim 1, which comprises the degree of loss of fine detail as a visual 10 impairment symptom in representing the input information description structure.

[Claim 9]

The invention according to Claim 1, which 15 comprises the degree of lack of contrast as a visual impairment symptom in representing the input information description structure.

[Claim 10]

20 The invention according to Claim 1, which comprises the degree of increased need of light as a visual impairment symptom in representing the input information description structure.

25 [Claim 11]

The invention according to Claim 1, which comprises the degree of loss of peripheral vision field as a visual impairment symptom in representing the input information description structure.

30

[Claim 12]

The invention according to Claim 1, which 35 comprises the degree of loss of central vision field as a visual impairment symptom in representing the input information description structure.

[Claim 13]

The invention according to Claim 1, which comprises the degree of loss of a left or right half

side of a vision field as a hemianopia symptom of visual impairment in representing the input information description structure.

5 [Claim 14]

The invention according to Claim 2, which comprises a user's sharpness presentation preference in representing the input information description structure.

10

[Claim 15]

The invention according to Claim 2, which comprises a user's enlargement presentation preference in representing the input information description structure.

15

[Claim 16]

The invention according to Claim 2, which comprises a user's explanation presentation preference in representing the input information description structure.

20

[Claim 17]

The invention according to Claim 2, which comprises a user's modality conversion presentation preference in representing the input information description structure.

25

[Claim 18]

The invention according to Claim 2, which comprises a user's presentation preference of the number of intensity levels in representing the input information description structure.

30

[Claim 19]

The invention according to Claim 2, which comprises a user's grey or colour selection presentation preference in representing the input information description structure.

[Claim 20]

The invention according to Claim 2, which comprises a user's minimum font size presentation preference in representing the input information description structure.

[Claim 21]

10 The invention according to Claim 2, which comprises a user's minimum font colour and background colour selection presentation preference in representing the input information description structure.

15 [Claim 22]

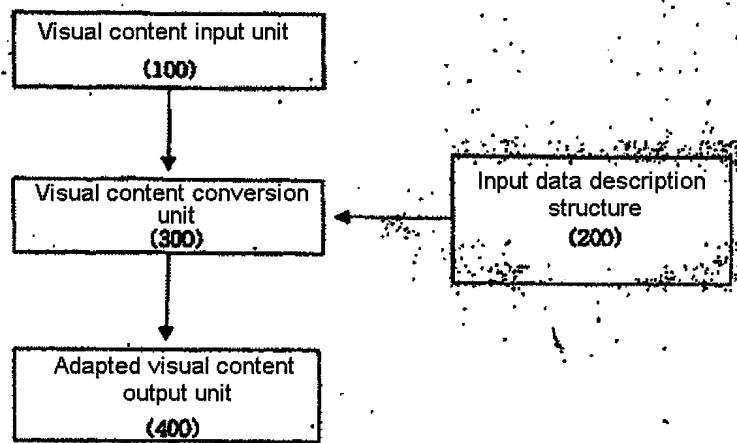
The invention according to Claim 2, which comprises a user's minimum font style selection presentation preference in representing the input information description structure.

20

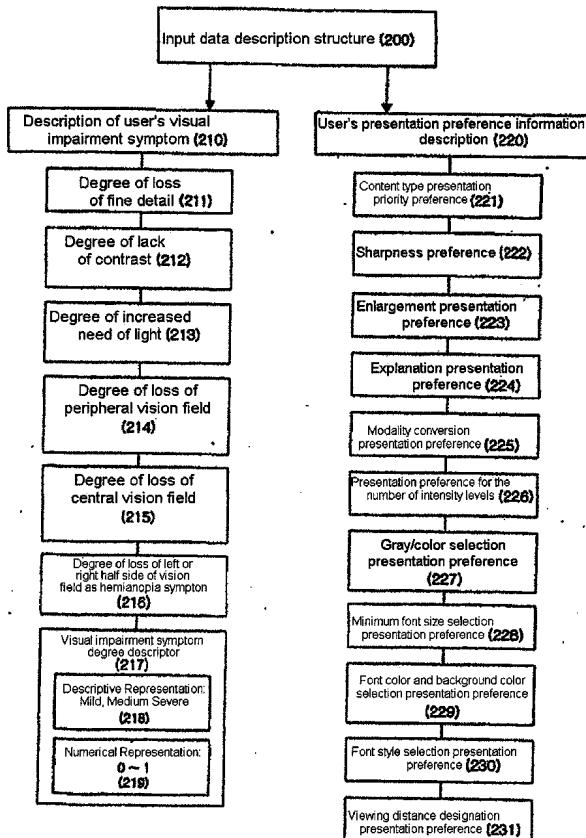
[Claim 23]

25 The invention according to Claim 2, which comprises a user's viewing distance designation presentation preference in representing the input information description structure.

[Fig. 1]



[Fig. 2]



[FIG. 3]

Adaptive Transformation Symptom	Contrast Control	Sharpness Control	Brightness Control	Glare Attenuation	Image Size Control	Modality Conversion
Loss of Fine Detail	○	○○	○		○○	○
Loss of Contrast	○○	○	○		○○	○
Increased Need of Light	○	○	○○	○○	○	○
Loss of Peripheral Vision Field	○	○	○		○○	○
Loss of Central Vision Field	○	○	○		○○	○
Hemianopia Symptom	○	○	○		○○	○